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Institutionalizing Emerging Technology Assessment Process into National Incident Response

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EXECUTIVE SUMMARY

The explosion and eventual sinking of the Mobile Offshore Drilling Unit *Deepwater Horizon* (*DWH*) resulted in the deaths of eleven crewmembers and a subsequent uncontrolled oil spill that tested the government's ability to respond to a spill of this magnitude as well as the regulatory framework that structures our country's response to oil spills.[1]

The purpose of this RDC report was to gather and evaluate the lessons learned from the government's assessment of emerging technology during the *DWH* response. The goal of this evaluation was to provide recommendations for processes and procedures for emerging technology assessment in future nationally significant emergency responses. The initial tasking was to look primarily at IATAP. Researchers gathered information from documents published about the response as well as interviews with USCG Research and Development Center (RDC) personnel and other Coast Guard personnel who had been involved in the response. It became clear early in the information gathering process that an evaluation of IATAP also required a similar discussion and evaluation of ART. A parallel effort sponsored by the American Petroleum Institute (API) also published a white paper entitled, "An Evaluation of the Alternative Response Technology Evaluation System (ARTES) Based on the Deepwater Horizon Experience." The API white paper looked at the ARTES process as it was used during the Deepwater Horizon spill response and provided recommendations for improving the ARTES process. RDC personnel were also members of the technical working group that developed the API white paper and used this RDC report as input to that white paper.

The scope, magnitude, and duration of the spill led to tens of thousands of ideas for new or improved oil spill control and response technologies being submitted to responders by the public, industry, universities, and non-governmental organizations. Leadership in the various parts of the response organization recognized the need for rapid assessment of these ideas early in the response. There was an additional related need to keep the submitters of these ideas from interfering with response operations. The response organization formed two groups to meet these needs. The Federal On-Scene Coordinator (FOSC) at the Unified Area Command (UAC) formed the Alternative Response Technologies (ART) organization at the request of the Scientific Support Coordinator (SSC). The ART was formed as part of the UAC/Incident Command Post (ICP) structure and heavily involved the responsible party, including the role as the ART lead. Later the National Incident Command (NIC) Interagency Solutions Group (IASG) formed the Interagency Alternative Technology Assessment Program (IATAP) to provide an independent, government-lead interagency perspective. The two groups had similar effective processes for assessing the technology ideas, both consistent with the National Oceanic and Atmospheric Administration's (NOAA's) Alternative Response Tool Evaluation System (ARTES). A major challenge faced by both groups, in the midst of the crisis, was field testing promising technologies.

The use of new and emerging technologies will continue to be important tools during responses to national emergencies. In future responses to any emergency where submissions to responders by public, industry, universities, and non-government agencies are likely to occur, the Emerging Technology Assessment (ETA) process (revised IATAP process) should be initiated and an integrated part of the UAC/ICP structure. The ETA lead should be a senior government employee with emergency planning and response experience and should be part of the UAC Command Staff. The Coast Guard Research and Development Program, depending on duration and severity of incident, should serve as the ETA process lead. There should be liaison positions in the command staffs of the NIC (if there is one) and the ICPs. The process for evaluating

technology ideas should include the successful aspects of those used for IATAP and ART. A more effective process for rapid field testing of ideas needs to be developed; details of this process are outside the scope of this paper.

BACKGROUND

Public misperception as to the roles of the federal government and the RP appear to be the primary reasons the NIC's IASG felt the need to form IATAP, even though the UAC already had a group (ART) performing a similar function. The RP was heavily involved in the ART organization, including providing its manager for the UAC and funding the expansion of their pre-existing database and testing processes. Many people believed ART was a uniquely RP, rather than UAC, role.

CG Admiral Thad Allen, the National Incident Commander, said despite its common use and a national exercise program intended to test and exercise the National Contingency Plan (NCP) over the years, the responders experienced both the political and social nullification of the NCP during the *DWH* response (National Incident Commander's Report, 2010). There were two primary reasons for this: (1) the statutorily defined role of the Responsible Party (RP) in an oil spill response was generally not understood or accepted by the public and all levels of government and (2) some state and local government officials balked at federal authority, direction, and control of resources in this response, preferring the Stafford Act response model. The public's stated concern was not being able to "trust" the RP to make every effort possible to clean up the oil. They did not believe the RP would place environmental response interests above the interests of the company and its shareholders. It was not widely understood that the RP does *not* direct or oversee the response. The role of the federal government is to ensure the RP fulfills all its obligations under the law. Federal primacy is necessary to provide a single point of control over the RP and promote unity of effort across all the impacted jurisdictions.

UNIFIED AREA COMMAND ALTERNATIVE RESPONSE TECHNOLOGY (ART) PROGRAM

The primary goal of the Alternative Response Technology (ART) Program was to improve the efficiency and effectiveness of response and cleanup operations through evaluation and testing of new and improved response technologies (Cortez, 2011). The UAC Scientific Support Coordinator (SSC) at ICP Houma established the ART Program on 2 May 2010 to deal with the external offers of response technology submitted to the ICP. RDC staff, with both operational and technical expertise in spill response and removal, were members of this group from its inception. As the numbers of offers continued to grow, NOAA hired people from California Fish and Game to help run the process, as they had been operating this type of program for the State of California.[2]

Typically, the ART group is responsible for all non-mechanical chemical and biological countermeasures that can be used in response to oil spills. However, in this response the ART organization did not have the responsibility for evaluating the chemical dispersants or for the controlled *in situ* burning. It did have the responsibility for evaluating ideas for novel mechanical methods, devices, and products, including oil sensors, booms, skimmers, decontamination, and waste minimization technologies.

The ART program was originally part of the Environmental Unit of the Planning Section of the Houma ICP and their job was to work with the Operations Section to determine what their needs were. The RP also set up a separate group in Houston, answering to the UAC in New Orleans, but physically located in Houston because the RP's Call Center and database were located there (but not officially part of the Houston-based ICP). The ART Program eventually evolved into an organizational structure that included the Technical Manager in Houston, a liaison at the UAC in Houma, and Strike Teams at various ICPs for field-testing technologies. They used a four-stage evaluation process based on NOAA's ARTES structure:[3]

Stage 1: Primary evaluation
- Classify (or reclassify) each idea based on feasibility, and determine if the idea should move forward.
- Email response to correspondent if selected for more detailed evaluation.

Stage 2: Classify each technology idea by type
- Dispersant, sorbent, mechanical, skimming, bio-restoration.

Stage 3: Technical review, by classification
- Further determine how feasible each technology is, and if it is already proven.
- Prioritize the ideas that should move forward.
- Email response to correspondent if selected for potential field deployment.

Stage 4: Technical review by operations
- High Interest Technology Test (HITT) Team and/or NOAA's ARTES desktop evaluation and/or field test.
- Closing response to correspondent.

Critical success factors for technologies being evaluated for potential field testing were:

- Material – will it make a real difference in terms of capability or result?
- Scalable – can it be used across the response effort?
- Timely – can it be used now?
- Viable – is it realistic to believe it will work?

ART collected approximately 400,000 submitted technical ideas, suggestions, and proposals. Approximately 100 suggestions were formally evaluated and/or field tested and approximately 25 of those saw significant use during response operations, including the Ocean Therapy oil/water separator, a heavy oil skimming system, and a fast-water oil boom deployment system.[4]

ART's close association with the Operations Section personnel and access to High Interest Technology Testing (HITT) resources and direct RP funding gave them a distinct advantage over IATAP in terms of field testing and operational implementation.

Interagency Alternative Technology Assessment Program (IATAP)

The *DWH* incident saw the first-ever designation of a National Incident Commander (NIC), a role specified by the NCP after the *Exxon Valdez* spill to communicate with affected parties and the public and to coordinate federal, state, local, and international resources at the national level in a SONS. To meet

increased political and public expectations, the NIC formed a staff to manage information flow and current planning needs, strategic planning requirements, strategic communications, and governmental affairs. One element of this staff was the Interagency Solutions Group (IASG), which met the mandate of the President for the NIC to be in charge of the entire incident, including coordination of federal agencies participating in the response. As issues arose, the IASG established interagency sub-groups to address them, including the Interagency Alternative Technology Assessment Program (IATAP) to collect and analyze thousands of response recommendations from all sources for the whole of government.

The formation of IATAP was necessary to address the overwhelmed ART with large amount of public, industry, and university idea submissions. The process created in IATAP addressed the feedback mechanism to innovators from a perceived non-biased identity and improved public affairs communications.

The NIC formed IATAP within the IASG at the RDC in May 2010 to ensure a fair and systematic, government-managed process to solicit, screen, and evaluate public, other government agency, and academia-suggested technologies in support of *DWH* spill response activities. IATAP consisted of representatives and assessment teams from multiple Federal Agencies, including the following:

- U.S. Coast Guard (CG).
- Minerals Management Services (MMS), which later became the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE).
- National Oceanic and Atmospheric Administration (NOAA).
- Maritime Administration (MARAD).
- U.S. Army Corps of Engineers (USACE).
- Environmental Protection Agency (EPA).
- U.S. Department of Agriculture (USDA).
- Fish and Wildlife Service (FWS).
- U.S. Navy Supervisor of Salvage and Diving (SUPSALV).

The RDC was able to quickly standup and support the IATAP Program by establishing an Incident Command structure including sections for Operations, Planning, Contracting, and Logistics. The Operations Section included an Assessment Unit, a USCG Evaluations Unit, and a Spill Unit. The Planning Section included a Situation Unit, a Documentation Unit, and a Congressional Inquiries Unit. The Contracting Section included the Broad Agency Announcement (BAA) Response Unit. The Logistics Section included the Admin Unit and the Information Technology Unit.

IATAP Process

The IATAP process was consistent with NOAA's ARTES structure and included:

Solicitation via BAA – on 4 June 2010 the Contracting Section issued a BAA for the purpose of organizing the collection and enhancing the Deepwater Horizon Response Team assessment of technology assistance offers by providing for the submission of white papers. The BAA was open to all national and international sources including single entities or teams from academia, private sector persons and organizations, government laboratories, and Federally Funded Research and Development Centers.

Screening (Initial Assessment) – An initial assessment of submissions was conducted where they were screened for technical feasibility, efficacy, and deployability to determine if they:

- Offered an immediate benefit (taken out of the BAA process and sent to the FOSC).
- Needed more evaluation.
- Did not support the incident (DNS).

Communications with Submitter – Several methods were employed to communicate with submitters to provide submission status including letters, an IATAP call center, and an Internet site. The Internet site was a secure site that allowed collaborative evaluations of proposals; and, using a private tracking number, allowed submitters to track the status of their proposals.

Proposed Technical Evaluation – The Assessment Unit established Technical Evaluation Teams (TETs) to assess the white papers based on their ability to fill one of five gaps. These gaps were defined in the BAA and were developed based on Subject Matter Expert (SME) input and interactions with the FOSCs.

- Wellhead Control and Submerged Oil Response.
- Traditional Oil Spill Response Technologies (booms, skimmers, etc.).
- Oil Sensing and Information Technology (IT) Improvements to Response and Detection (includes simulations, oil tracking and reporting, communications, and data handling).
- Alternative Oil Spill Response Technologies (in situ burning, dispersants, etc.).
- Oil Spill Damage Assessment and Restoration.

The TETs used four evaluation criteria:

- Overall Scientific or Technical Merit,
- Feasibility,
- Availability of Proposed Solution, and
- Rough order magnitude (ROM) Cost (least important of the four).

Evaluation Unit (EU) – The TET lead sent ideas that appeared to have merit to the Evaluation Unit lead to distribute to the relevant IATAP agency representative (CG, EPA, NOAA, MMS (later BOEMRE)) for further evaluation.

Field Testing – The original plan was to use a follow-on contract for field testing, because the initial solicitation was via BAA. However, none of the submissions were independently field tested following the full BAA process. RDC personnel were in contract negotiations with several universities, but it was discovered that their products weren't ready for a field test. Several submittals that were in the category of offering an immediate benefit were sent directly to the FOSC. At that point, if FOSC personnel deemed the submittal a relevant but in need of further testing, they could then forward them to ART to arrange field testing.

Data Management – Review of and comments on BAA submittals was conducted through the CG's secure collaborative website "Homeport." Homeport was chosen because it allowed people from outside the CG to use it (other agency and contractor reviewers), while maintaining the appropriate security for the procurement process.

RDC was able to fully support the standup of the IATAP Program by temporarily shifting technical staff resources and suspending or placing some research efforts on care taker status. The trial-by-fire demonstrated that USCG RDC with its ongoing multi-mission technology research areas that include oil spill response, search and rescue/mass rescue, oil-spill-in-ice, arctic, and maritime security make it a viable candidate for systematic support of emerging technology, i.e., technical evaluation unit, in a National crisis of this nature.

LESSONS LEARNED

IATAP developed successful processes for efficiently screening and evaluating technology ideas. Neither organization was in an appropriate location in the response structure to be fully effective. Both IATAP and ART had some issues with communication and implementation primarily due to location within ICS structure.

According to interviewees, IATAP met the important goal of giving the public a government outlet through which to submit their response ideas for evaluation. Also, IATAP was able to conclude the RP was not ignoring potential fixes to save money,[5] and it provided independent verification that the technologies being deployed were the best available for the operational needs.

Linkage and Communications

ART and IATAP were located in different places in the response organization and neither placement was ideal. A technology assessment group needs to be part of the command staff of an ICP or UAC. There should be liaisons between the different command functions and within the organization to ensure efficient and effective communications flow.

Some people in the UAC/ICP organization knew IATAP existed but they weren't always sure what role it was playing. An IATAP liaison was briefly assigned to the UAC's Critical Resources Unit (CRU) to help define the handoff from evaluation to consideration for operational deployment. The CRU is tasked with finding equipment needed immediately in the operational response.

Communications between the technology groups, IATAP and ART, and UAC were difficult at times as a result of location within the response effort. IATAP location as an offshoot of the NIC working under the IASG provided communication levels to answer political inquiries but was not effective in linking into UAC planning and operations. The ART, on the other hand, was located within the ICP and also experienced difficulty effectively communicating efforts to test potential technologies through the UAC.

Process

By late April 2010, the ART database was up and functioning and available to the general public. The web interface was designed to provide a simple mechanism for the general public and interested parties to submit ideas to the Unified Command regarding new and improved technologies. The database was used to collect more than just technology ideas which lead to an overwhelming 400,000 submittals of which only a portion were tech suggestions. In June 2010, IATAP received e-mail responses to the BAA and loaded them into Homeport for evaluation. Both organizations used Subject Matter Experts to quickly screen and do the initial review/evaluation of the submissions.

Implementation Issues

The UAC had difficulty field-testing and implementing technology ideas from both IATAP and ART , although ART was able to eventually overcome most of its issues. ART was more successful than IATAP in this respect because it had direct linkage to the ICP and teams within the ICP to test. However, they still had problems getting access to response resources because they weren't officially part of the ICP process.[6] IATAP was not successful in field-testing promising ideas. A number of factors contributed to this lack of success:

- IATAP was basically an evaluation process. As with ART, only a very small percentage of proposals merited consideration for field testing.
- The choice of a BAA as the contracting vehicle for solicitation because it limited sharing of submissions with the UAC because of procurement sensitivities.
- The CG didn't have enough buy-in from the other agencies involved in the Evaluation Unit (EU).[7] IATAP was established outside the UAC and was working in parallel with ART. Resources from other agencies with decision-making authority were involved in other aspects of the response efforts.
- Technology ideas not being ready for field testing (primarily an issue with universities).
- The IATAP liaison at the UAC was located in the Critical Resources Unit (CRU). CRU personnel were interested in equipment that could be used immediately. Because of this, they are not the best people to be looking at testing emerging technology.
- The testing of equipment during the response was limited primarily for two reasons:
  - The FOSC/UAC was focused on operational issues and testing was not a priority, and
  - The non-integration of ART and IATAP in the ICS structure at the FOSC/UAC level resulted in difficulty communicating potential testing opportunities and relating them to the current objectives.

Evaluation and implementation of new technology, for both ART and IATAP, does not currently have a standard location in the emergency response structure.

RECOMMENDATIONS

The unique and complex nature of a national incident such as *DHW* challenges emergency response technology and often requires innovative solutions. Responders, to any large emergency, need to have a mechanism that efficiently and effectively evaluates and helps implement new, emerging, or non-conventional technologies in the ongoing response. The proposed ICS organization recommends that a single mechanism meeting this need be incorporated into the ICS organization as a dedicated position; and that its process be scalable to the size of any type of incident response where new technologies may be valuable to the success of incident response. Organizationally, this could initially start out as one person filling the liaison position and grow to a workforce supporting the ETA.

Integrate Emerging Technology Assessment (ETA) into the UAC through the Incident Command System (ICS)

Emerging Technology Assessment (ETA) should be an integral and recognized component of the NIMS ICS organization. The structure should be scaled to address multiple command posts and a UAC, as appropriate. The NIMS core document currently discusses Operational Scientific Support under "Ongoing Management and Maintenance":

"Operational scientific support identifies and, on request, mobilizes scientific and technical resources that can be used to support incident management activities. Operational scientific support draws on the scientific and technological expertise of other agencies and organizations. Planning for this category of support is done at each level of government through NIMS preparedness organizations. Operational scientific support is requested and provided through various programs coordinated by DHS and other organizations and agencies."

NIMS does not, however, specify how this support should fit into the UAC/ICS Operational Command structure. The following proposed ICS structure should solve the linkage problem. Figure 1 shows the proposed ICS structure for a response under the NCP (oil spill or hazardous materials release). Figure 2 shows the proposed ICS structure for a response under the NRF (other national emergency). The blue shaded boxes represent ETA process additions to these two structures in Figures 1 and 2. Nothing else is changed in the NCP and NRF structures except the addition of the ETA components. In future responses, the lead for ETA should be a member of the UAC Command Staff. There should be liaison positions in the command staffs of the NIC (if there is one) and the ICPs to ensure timely and accurate communication flow.

National Incident Response ETA Goals and Objectives

The primary goal of the NIMS ETA Program would be to identify response technologies that can improve the efficiency and effectiveness of emergency response operations. The secondary goal would be to serve as a buffer between those with ideas and operations personnel to minimize impact on response operations. The objectives and priorities to meet these goals are:

1. Establish a multi-stage review and testing process to vet new ideas from all sources against the defined operational needs of the incident.
2. Provide a process for safe, efficient, and deliberative test and evaluation of products, equipment, and applications proposed for use in the emergency response.
3. Document the capabilities and limitations of these items for consideration by the Operations and/or Logistics Sections of the ICPs.
4. Ensure that all testing and evaluations are in compliance with all applicable regulations including procurement regulations, environmental requirements, and health and safety standards.
5. Keep abreast of technologies and applications emerging in the field and provide coordination and feedback for their development.
6. Communicate effectively with the NIC, other UAC components, the ICPs, and other stakeholders.
7. Establish linkage with Public Affairs liaison to effectively communicate with general public and government stakeholders.
8. Establish effective communication method with solicitors providing timely and productive feedback on potential ideas.

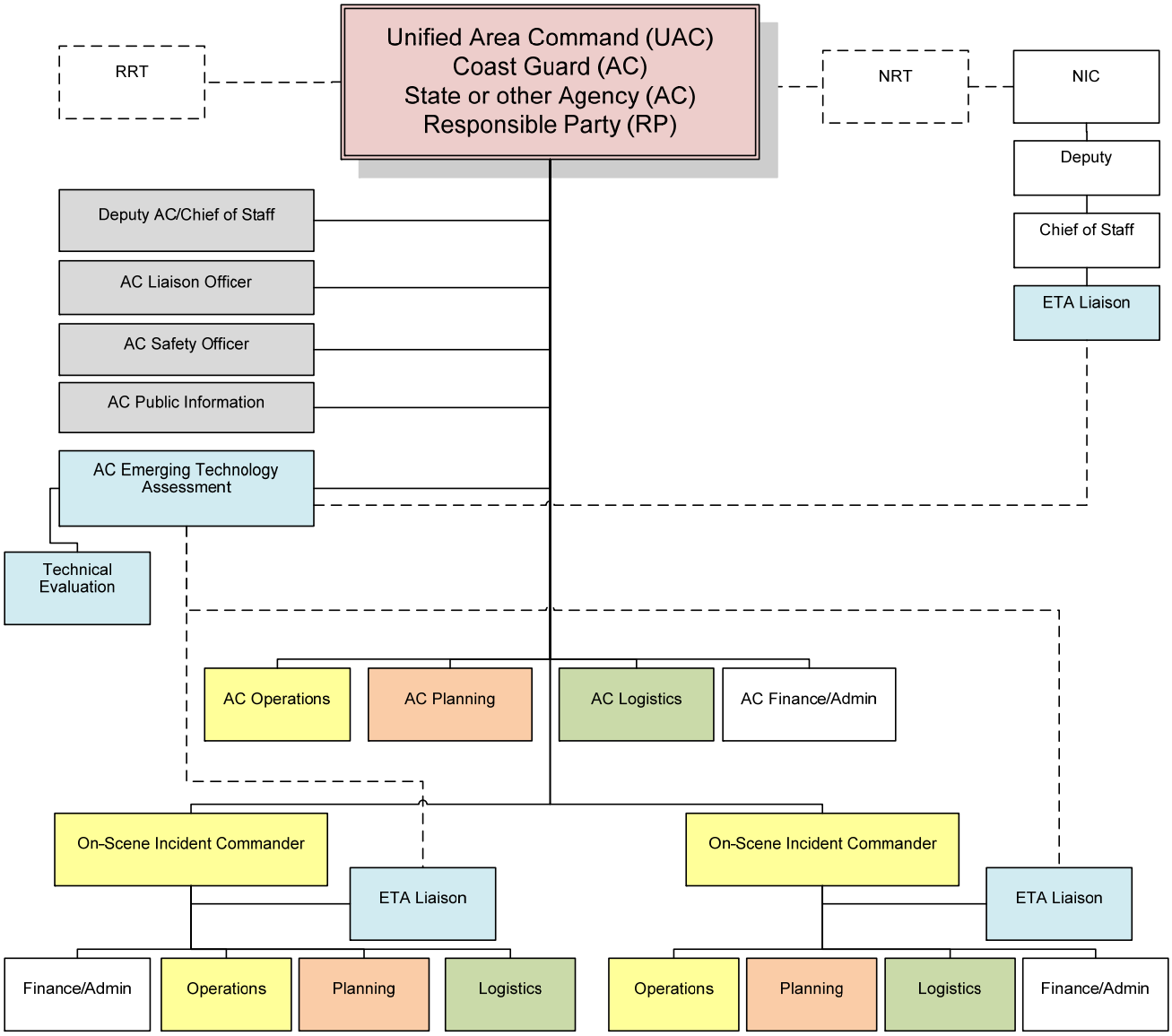

Figure 1. Recommended UAC organizational structure - NCP.

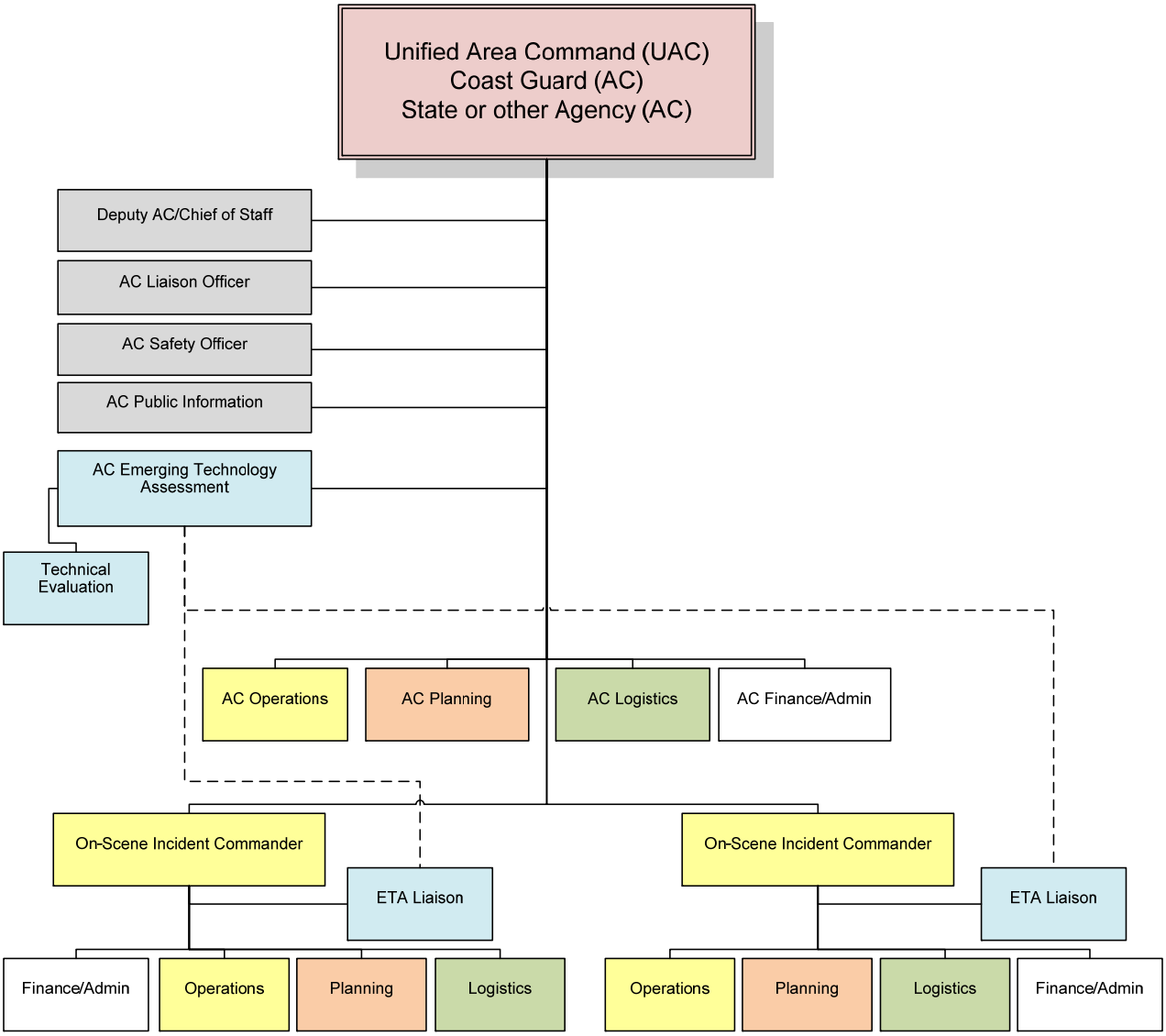

Figure 2. Recommended UAC organizational structure - NRF.

Participants

The UAC ETA Manager (see AC Emerging Technology Assessment block in Figures 1 and 2) should be a senior government employee on the UAC Command Staff. In the case of another catastrophic oil spill, this would likely be a CG person, either an O-6 or GS-14 spill MEP/MER specialist. There should be team leads as necessary for the various assessment stages (screening, evaluation, testing, etc.). If a NIC is established, there should be a liaison position on the command staff, potentially filled by an O-6 from the RDT&E Program (similar to the *DWH* response). There should be a liaison on the Command Staff of each ICP, with additional staff as needed. Interagency participation is vital. The ETA Manager can use the Regional Response Team (RRT) members to obtain access to other agency personnel. The UAC ETA Manager role can be filled by State or other Federal Agency individual for other incidents (i.e. natural disaster response).

Proposed Improved Process

The recommended ETA process (Figure 3) is based on the successful aspects of the IATAP and ART processes. The response requirements identified by Operations (most likely at the ICP level) are an important input into the process. Ongoing RDT&E efforts are not technically part of the response process, but may intersect with it in one of two ways:

- Ongoing R&D efforts may be ready to test for immediate response and could be submitted for screening.
- Ideas from the ETA process that are not ready for testing or implementation can be referred to ongoing RDT&E provided funds availability/priority.

The recommended ETA process includes rapid testing and evaluation (T&E) of promising ideas. The inclusion of ETA as a standard, accepted part of emergency response should allow for operations resources to be made available to the ETA manager to conduct T&E. If the proposed ETA process is adopted, detailed responsibilities and roles will need to be developed.

The primary stages of the ETA process are:

1. Identify response requirements (this is an ongoing feedback process with operations at all levels). The FOSC/UAC is responsible for this task.
2. Solicitation
   a. A standardized document submission format and minimum required information level should be established.
   b. Submission/idea must be made available for testing at submitters' expense.
   c. Make public aware so issues are addressed upon initial submission and indicate that submissions should be implementable within the incident response time frame.
   d. Caution the public there will be large numbers of responses – manage expectations for replies to public.
3. Screening
   a. Establish specific "Does Not Support" criteria with respect to how soon the item is needed to be ready to implement.
   b. Establish response for potential solutions submitted when there is no longer a requirement/need for that issue.
4. Test and Evaluation
   a. Develop and institute a scoring system that is suitable for ranking submissions and that properly weights the ability to test and "fit" with current spill recovery operational needs.
   b. Establish a procedure for quickly and efficiently testing technologies with potential merit.
5. Implementation
   a. Establish alignment with goals and objectives of UAC for testing of new technologies; include in the operation period planning and reporting.
   b. Ensure that equipment/services submittals have a clear path to those in operations/ logistics for use.
   c. Interaction with interagency and government representatives, general public, and solicitors of ideas/solutions.
   d. Establish and implement an external, pro-active communication strategy and promote successes.

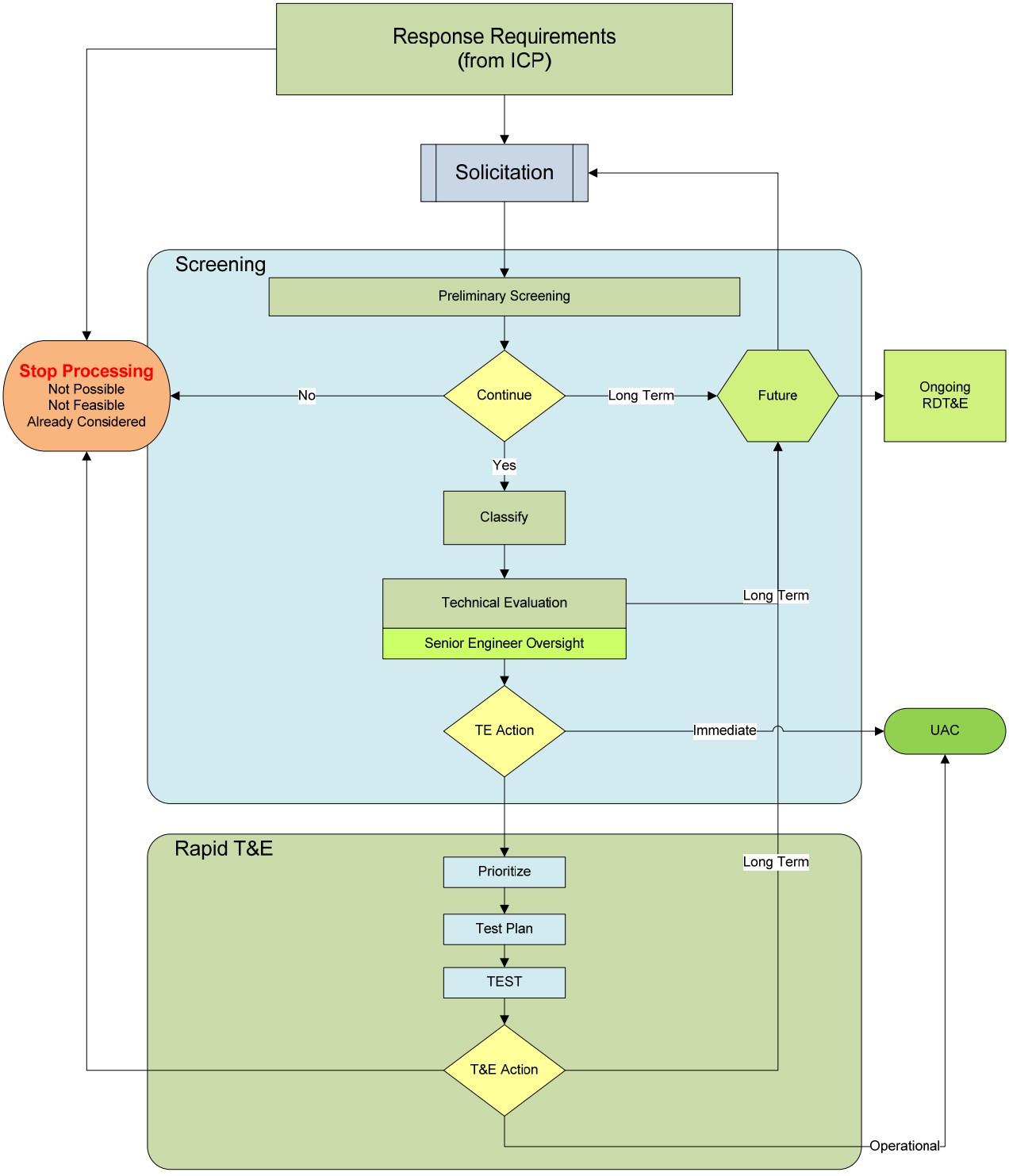

Figure 3. UAC emerging technology assessment process.

Implementation Methods

The details of the solicitation process and related contracting issues need to be determined prior to an event. While the BAA process is probably the best fit for the ongoing RDT&E function, it may not be the most efficient process for rapid T&E. A Request for Information (RFI) followed by individual solicitations may be a more flexible method to rapidly conduct T&E within the UAC and ensure linkage with UAC objectives.

The selection and programming of a database to document and track the ETA process is critical. A single database should be established to hold all submissions, regardless of their source. Entries into the database should be made via an internet submission system giving the public a way to submit ideas as an avenue for helping address incident issues. The data management system needs to be set up and exercised prior to an event.

Interagency participation is critical. It is also important to include experienced responders. Communications between the various levels of the ETA organization is extremely important. There should be liaisons between the different command functions and within the ETA organization to ensure efficient and effective communications flow.

Example scenario describing implementing ETA in the ICS structure (e.g. Oil Spill in Arctic):

Upon initial standup of ICP for an oil spill in Arctic, the D17 MER/MEP specialist assumes the ETA position. If additional support is needed, specific skills requested could be filled to assist the ETA in fielding new technology solicitations/ideas to On-Scene Commander. If the incident response grew similar to DWH, the D17 MER/MEP specialist or O-6 could be assigned the role of ETA at UAC. The ETA liaison at UAC would have ability to scale resource support to incident level including establishing a technical evaluation unit to review potential technology solicitations. The technical evaluation unit should consist of experts in a variety of specialties (i.e. oil spill mechanical, oil spill chemical, field test planners, evaluators). Given the government-led research underway in oil spill response in ice, arctic communications, arctic surface craft technologies, and expertise in risk methodologies, the RDC could be a good candidate for support of the technical evaluation unit. If a NIC is established for this scenario, RDT&E Program (CG-926) staff can serve as ETA liaison.

Incorporate in Future Exercises

The structure for ETA should be incorporated into NIMS/ICS documents and exercised as part of emergency response. The following are some recommended CG-53/RDC steps forward:

- RDC should provide information and suggestions to the DWH After Action Working Group.
- RDC should work with CG-53 in verifying and validating an appropriate structure for NIMS/ICS documents.
- CG-53 should work with District response planners to integrate ETA process and responsibilities into Regional and Area Contingency Plans.
- CG-53 should include ETA in Area, Regional, and National emergency response exercises.
- RDC should work with CG-53 in developing an OV-1 for how, organizationally, it would be ready to execute ETA support in the next significant event, e.g. as a technical evaluation unit, and test the new organizational structure in “Table Top” exercise.

Preparedness organizations may take the following actions, among others:

Plan for operational scientific support, which can be done at each level of government, and contribute ideas to ongoing research and development of new technologies.

Ongoing development of science and technology is integral to the continual improvement and refinement of NIMS. Strategic R&D ensures that this development takes place. NIMS also relies on scientifically based technical standards that support incident management. Maintaining a focus on appropriate science and technology solutions will necessitate a long-term collaborative effort among NIMS partners.

To ensure the effective development of incident-management science and technology solutions, the NIC must work in coordination with the DHS Under Secretary for Science and Technology to assess the needs of emergency management/response personnel and their affiliated organizations.

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[4] Communication with ART Technical Manager.

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